

CLAIMS

1 1. A system for registering an object in six degrees of freedom using a machine
2 vision system comprising:

3 a search tool of the machine vision system adapted to recognize a plurality of in-
4 stances of a trained pattern, the plurality of instances each being transformed to exhibit
5 different amounts of aspect and shear.

1 2. The system as set forth in claim 1 wherein the search tool is further adapted to
2 provide a plurality of search results corresponding to a plurality of instances of the
3 trained pattern.

1 3. The system as set forth in claim 2 further comprising a combiner that uses the
2 plurality of search results so as to provide a location of the object in the six degrees of
3 freedom.

1 4. The system as set forth in claim 3 wherein the combiner includes means for
2 providing aspect and shear given search results corresponding to different instances of the
3 trained pattern on the object, wherein found relative positions of the instances of the
4 trained pattern is compared with known relative positions of the instances of the trained
5 pattern.

1 5. The system as set forth in claim 4 wherein the means for providing includes a
2 linear transform between the expected relative position of each of the instances of the
3 trained pattern and a normalized measured position of the instances of the trained pattern.

1 6. The system as set forth in claim 1 wherein the plurality of instances of the
2 trained pattern comprise a plurality of transposed, synthetically generated image data, and
3 the different amounts of aspect and shear are based upon predetermined known incre-
4 ments.

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1 7. The system as set forth in claim 1 wherein the plurality of instances of the
2 trained pattern comprise a plurality of different user-specified values for aspect and shear
3 provided at runtime to the search tool so as to change an orientation of the trained pattern.

1 8. The system as set forth in claim 1 wherein the plurality of instances of the
2 trained pattern each comprise portions of an overall pattern.

1 9. A method for registering an object in six degrees of freedom using a machine
2 vision system comprising:

3 recognizing, with a search tool of the machine vision system, a plurality of in-
4 stances of a trained pattern, the plurality of instances each being transformed to exhibit
5 different amounts of aspect and shear.

1 10. The method as set forth in claim 9 further comprising providing, with the
2 search tool, a plurality of search results corresponding to a plurality of instances of the
3 trained pattern.

1 11. The method as set forth in claim 10 further comprising combining the plural-
2 ity of search results so as to provide a location of the object in the six degrees of freedom.

1 12. The method as set forth in claim 11 wherein the step of combining includes
2 providing aspect and shear given search results corresponding to different instances of the
3 trained pattern on the object, and including comparing found relative positions of the in-
4 stances of the trained pattern is compared with known relative positions of the instances
5 of the trained pattern.

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1 13. The method as set forth in claim 12 wherein the step of providing aspect and
2 shear includes applying a linear transform between the expected relative position of each
3 of the instances of the trained pattern and a normalized measured position of the instances
4 of the trained pattern.

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13. The method as set forth in claim 11 further comprising scoring each of the plurality of search results and selecting best scoring of the search results for combining by the step of combining.

15. The method as set forth in claim 9 wherein the plurality of instances of the trained pattern comprise a plurality of transposed, synthetically generated image data, and the different amounts of aspect and shear are based upon predetermined known increments.

16. The method as set forth in claim 9 wherein the plurality of instances of the trained pattern comprise a plurality of different user-specified values for aspect and shear provided at runtime to the search tool so as to change an orientation of the trained pattern.

17. The method as set forth in claim 9 wherein the plurality of instances of the trained pattern each comprise portions of an overall pattern.

18. A computer-readable medium including program instructions executed on a computer for registering an object in six degrees of freedom using a machine vision system, the computer-readable medium including program instructions for performing the steps of:

recognizing, with a search tool of the machine vision system, a plurality of instances of a trained pattern, the plurality of instances each being transformed to exhibit different amounts of aspect and shear.

19. The computer-readable medium as set forth in claim 18 further comprising providing, with the search tool, a plurality of search results corresponding to a plurality of instances of the trained pattern.

20. The computer-readable medium as set forth in claim 19 further comprising combining the plurality of search results so as to provide a location of the object in the six degrees of freedom.

1 21. The computer-readable medium as set forth in claim 20 wherein the step of
2 combining includes providing aspect and shear given search results corresponding to dif-
3 ferent instances of the trained pattern on the object, and including comparing found rela-
4 tive positions of the instances of the trained pattern is compared with known relative po-
5 sitions of the instances of the trained pattern.

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1 22. The computer-readable medium as set forth in claim 21 wherein the step of
2 providing aspect and shear includes applying a linear transform between the expected
3 relative position of each of the instances of the trained pattern and a normalized measured
4 position of the instances of the trained pattern.

1 23. The computer-readable medium as set forth in claim 20 further comprising
2 scoring each of the plurality of search results and selecting best scoring of the search re-
3 sults for combining by the step of combining.

1 24. The computer-readable medium as set forth in claim 18 wherein the plurality
2 of instances of the trained pattern comprise a plurality of transposed, synthetically gener-
3 ated image data, and the different amounts of aspect and shear are based upon predeter-
4 mined known increments.

1 25. The computer-readable medium as set forth in claim 18 wherein the plurality
2 of instances of the trained pattern comprise a plurality of different user-specified values
3 for aspect and shear provided at runtime to the search tool so as to change an orientation
4 of the trained pattern.

1 26. The computer-readable medium as set forth in claim 18 wherein the plurality
2 of instances of the trained pattern each comprise portions of an overall pattern.